REMARKS

By the foregoing amendment, claims 1, 7 and 20 have been amended while claims 9 and 11 have been cancelled. In addition, claims 9 and 11 have been cancelled to reduce the issues present in the case.

It is noted that Applicants are concurrently filing a Petition to the Commissioner seeking withdrawal of the election requirement.

The rejection of claims 1-3, 7, 12 and 20 is no longer believed applicable in view of amendments to claims 1, 7 and 20. Similarly, it is further believed that the rejection of claims 7 and 16 is improper because the claims on which they depend have not been rejected on the same ground.

Viewing claims 1 and 20, it should be observed that the same specify that the flow spaces exist between the runs and specifically between the points of abutment of the runs with other of the runs as well as between the points of abutment with the runs in the salt case. Claims 1 and 20 also required that "each run at the exterior of the matrix additionally engage the salt case".

This arrangement of elements is not shown or suggested by either Kanada or van Heel.

Kanada does not show an equilateral polygonal pattern in his matrix of elements except in Figs. 1 and 18b. His salt case is the inner vessel 2 which is disclosed at column 5, line 41 as being cylindrical. In such a case,

it is physically impossible for each run on the exterior of the matrix to abut the salt case wall. See, for example, Fig. 3 of van Heel which shows such impossibility.

In Fig. 18b, the tubes on the exterior of the matrix are not shown as contacting the wall 2 but in any event, it is clear that even if they did, a number of the runs on the exterior of the matrix would not contact the inner wall of the salt jacket 2. And when a random distribution of the tubes is utilized as shown in Fig. 18a of Kanada, large gaps exist between certain of the tubes on the exterior of the matrix as shown in the upper right hand 90° of that figure which has the effect of reducing the capacity for the containment of the salt being utilized and provides flow paths of relatively nonuniform size wherein the larger flow paths would allow the heat exchange fluid to short circuit the smaller flow paths and reduce heat exchange between the fluid and the salt in the containers.

This deficiency is not overcome by van Heel, notwithstanding the statement by the Examiner that such an arrangement is shown. As is clearly apparent from Fig. 3, none of the salt tubes on the exterior of the matrix contact the interior wall of the salt case. That is because the salt containing tube are disclosed at 16 and each in turn is surrounded by two additional tubes 17 and 18.

Furthermore, even if the tubes 18 were to be considered, albeit erroneously, as the salt tubes, it is completely apparent from Fig. 3 that every other one of the tubes 18 on the exterior of the matrix does not contact or abut the inner wall of the salt case as claimed.

That being the case, the references, whether singly or in combination, do not show the subject matter of independent claims 1 and 20.

This difference is of no small moment. The Applicants are attempting to obtain a very compact latent heat battery that has a high heat storage capacity. Both Kanada and van Heel clearly do not fill their salt cases with tubes containing the salt or phase change material and as a consequence, the capacity for storing heat is reduced. Similarly, because numerous gaps such as those that are apparent in Figs. 18a and 18b of Kanada and which are created by the presence of the additional tubes 17 and 18 in van Heel, are present, the salt case is not as compact as in Applicants' device, thereby providing Applicants' device with a substantial and patentable advantage.

Addressing claim 7, it is noted that it is dependent upon claim 6 which has not been rejected solely on Kanada and van Heel. Thus, claim 7 would not seem to be properly rejected.

In any event, claim 7 specifies that each of the tube runs has six contact points with other runs or with the salt case and that there is one of the flow spaces between each pair of adjacent ones of the contact points. Fig. 1

and Figs. 18a and 18b of Kanada lack any disclosure of each of the tubes having six contact points. As a result, the cross-sectional area of the flow paths can be asymmetrical with the larger flow paths tending to short circuit the smaller ones. Neither compactness nor maximum heat capacity is obtained.

Similarly, van Heel, in Fig. 3, shows that every other tube at the outside of the matrix lacks six contact points when the tubes 18 are considered. However, the claim requires that the tubes containing salt have the six contact points and in the case van Heel's tubes 16, none have any contact points whatsoever with the adjacent tubes containing the salt.

And it should be kept in mind in the case of van Heel that van Heel is trying to provide a heat storage element for a home or the like. As a consequence, the same requires concentric tubes 17 and 18 in addition to the tube 16. The inner tube 17 is intended for air flow for heating the interior space of a house while the outer tube 18 receives air or water from a photo cell array shown at 1 in Fig. 1. Quite clearly, van Heel is totally unrelated to latent heat batteries of the type of concern and does not teach Applicants' because of all the additional space required by the additional tubes which minimize the capacity of any given unit to contain a phase change material and increases the bulk to make it unsuitable for applications, such as vehicular applications, where space is at a premium. van Heel teaches nothing about the subject invention.

Claims 2, 3 and 12 respectively depend directly or indirectly on claim 1 and are believed to be patentable for the same reasons.

Respecting claim 16, the same depends upon claim 13 and the Examiner has not suggested that claim 13 is unpatentable over van Heel and Kanada so it follows that claim 16 is improperly rejected.

Respecting claim 20, the same is patentable over van Heel and Kanada for the same reasons as claim 1.

The rejection of claims 4 and 5 is unpatentable over Kanada in view of the Tsunekawa Japanese patent is traversed. These claims directly or indirectly upon claim 1 and are believed to be patentable for the same reasons. Moreover, Tsunekawa is clearly from a nonanalogous art. It relates to a Stirling engine which is a far cry from a heat battery. In other words, Tsunekawa teaches nothing to one skilled in the art of heat batteries. Indeed, it is not even clear that the elements shown in Figs. 2 and 3 relate to heat transfer of any sort; and clearly, the tubes 13 do not appear to contain a phase change material as required. Any rejections relying, in whole or in part, on Tsunekawa is clearly hindsight based.

The rejection of claims 6 and 14 as unpatentable over van Heel in view of Colvin is traversed. Claim 6 depends upon claim 1 and is believed to be patentable for the same reasons.

Claim 14 depends from claim 13 which has not been similarly rejected. Accordingly, it is not seen how the rejection can apply to claim 14.

Furthermore, Colvin is inapplicable because Colvin does not relate to tubes containing a phase change material. Rather, the phase change elements in Colvin are so-called macro capsules wherein a phase change material 40 is contained within a protective shell 42. These components are spherical, not elongated tubes. As a result, there is considerably greater void space in the Colvin device and the high capacity sought and obtained by the Applicant is missing. Nothing in Colvin suggests that the macro capsules could be replaced by tubes, and indeed, to do so would destroy the teachings of Colvin for their intended purpose. One skilled in the art would never go against the primary teaching of a reference as a result of obviousness. Clearly, Colvin is inapplicable to any of the claims.

The rejection of claims 8 and 17 as unpatentable over Kanada in view of Boyer et al is traversed. Referring to claim 8, the same requires the salt case to have a plurality of parallel, elongated, inwardly spaced ribs with the runs having spaced centers and the spacing between the ribs being the same as the spacing between the centers of the runs. It further requires that the runs on the exterior of the matrix are nested between two adjacent ribs with each run having one of its contact points, as defined in claim 7, with each of the two adjacent ribs.

Boyer, on the other hand, merely relates to a bracket used in a shell and tube heat exchanger, which bracket is to support the tubes of a heat exchanger, not tubes containing a phase change material. There are no elongated inwardly directed spaced ribs, and to the extent that the brackets could be considered as such, the spacing of the ribs is not the same as the spacing between the centers of the tubes as claimed. Further, in the Boyer device, the tubes cannot be in abutment with one another and so combining Boyer with other references to achieve Applicants' claimed structure is simply an impossibility. The rejection is manifestly improper and should be withdrawn.

With respect to claim 17, the same depends upon claim 13 and since claim 13 has not been rejected on the same combination of references, it does not appear that the rejection has any proper basis. Moreover, claim 17 calls for the outer jacket to include a plurality of strengthening ribs and no such structure is apparent from Boyer.

The rejection of claim 10 over Kanada in view of Takahashi is likewise traversed. Claim 10 depends upon claim 1 and is believed to be patentable for the same reasons.

Moreover, the elements 3 of Takahashi are not baffles but rather, "metal nets". They are simply supports for the tubes. Moreover, even if they were baffles, they do no extend through the matrix between the runs to

provide a two pass system as is the case with the structure of claim 10. Claim 10 is clearly allowable.

The rejection of claim 13 as unpatentable over van Heel further in view of Boyer is respectfully but strongly traversed. As noted above, van Heel does not show or otherwise suggest the presence of tube runs with each run inwardly of the matrix abutting a plurality of adjacent runs and each run at the exterior of the matrix additionally engaging the salt case. The tubes 16 of van Heel are separated from engaging other of the tubes 16 by the intervening tubes 17 and 18.

Further, Boyer is clearly inapplicable for the reasons stated previously in that it does not disclose a pair of parallel, inwardly directed spaced elongated ribs on center spaced a distance equal to the spacing between the centers of the runs with the runs on the exterior of the matrix being nested between corresponding ones of the ribs and engaging the ribs along their respective lengths as set forth in claim 13. The rejection is clearly improper and should be withdrawn.

The indication of the presence of allowable subject matter in claims 18 and 19 is noted with appreciation. However, rewriting the same in independent form has been deferred because it is believed that the base claims of claims 18 and 19 are allowable and their form, therefore, proper.

In summary, the prior art simply fails to disclose the subject matter of the various independent claims in the case as well as that of many of the dependent claims for the reasons aforesaid. Applicants' invention provides a high capacity, low volume latent heat battery which is incapable of being attained through the teachings of the prior art. Moreover, the concentric tube arrangement of van Heel and/or the mounting bracket set up of Boyer simply do not permit compact nesting of the tube runs containing the phase change material in abutting relation with each other and/or with the salt case which provides for the low volume high capacity feature of Applicants' invention. Similarly, Kanada fails to show or otherwise suggest how high capacity coupled with low volume can be obtained. Colvin and Takahashi all relate to the use of spheres in a latent heat unit and therefore do not disclose or otherwise suggest how compactness with the use of tubes can be obtained; nor do they suggest how the higher heat capacity of Applicants' invention is achieved because a greater amount of phase change material may be maintained in a given space through the use of tubes than can be obtained with the use of spheres.

It therefore follows that since one or more of such features are found in the structures of all the claims remaining in the case, such claims are

in allowable form and the case should be allowed. Notification to that effect is solicited.

Respectfully submitted,

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